PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventor: HERBERT MARTIN ASHTON

826,301

Date of filing Complete Specification (under Section 3 (3) of the Patents Act, 1949): July 14, 1958.

Application Date: Sept. 25, 1957. No. 30075/57.

Application Date: Sept. 25, 1957. No. 30076/57.

Complete Specification Published: Dec. 31, 1959.

Index at acceptance:—Class 113, A1.

International Classification:—B63b.

COMPLETE SPECIFICATION

Improved Collapsible Floating Containers for Liquids

We, ESSO RESEARCH AND ENGINEERING COMPANY, a Corporation duly organised and existing under the laws of the State of Delaware, United States of America, of Elizabeth, New Jersey, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to improved means for transporting liquids.

It has previously been proposed that floating containers designed to hold liquids having a density less than water and to float in water, may be made of collapsible fabric, for instance, rubberized fabric. Such containers are closed containers and may be filled with the liquid to be stored through an aperture specially designed for that purpose.

A particularly useful container of the above type is one that is capable of being towed. Such "collapsible barges" consist in effect of tubes, which may comprise one compartment or several compartments, which may or may not be connected to each other. One end of the tube has towing means connected to the ship or tug pulling it, and the other end may conveniently terminate in the filling pipe hereinbefore mentioned, although the after end may be blind. It has previously been found that when such a container is designed for being towed, the ratio of the length to the cross-sectional area of the container should be large. The most convenient cross-section of such containers has a cylindrical or near cylindrical form, and in such instances it has been found that ratio of length to beam should be greater than 6:1, and preferably greater than 10:1. A particularly useful container is one having a length/diameter ratio of about 20:1.

It has been found that cylindrical or near-cylindrical containers of the type described above and hereinafter designated "of the type referred to," tend to roll, particularly when being towed. This rolling action is generally undesirable, due to the necessity of keeping gas vents and other devices above the water-line, and is due to the centre of buoyancy being coincident with the centre of gravity of the container.

It has now been discovered that the tendency to roll of floating containers of the kind referred to may be inhibited by the presence of a water-filled collapsible bag fixed to the skin of the container. Thus when the container is filled with the liquid of density less than water, the water-filled bag will tend to reach a point directly beneath the centre of buoyancy of the liquid-filled container, and act as a keel. It has the further advantage that after the liquid cargo of the container has been discharged, the water in the collapsible bag may also be discharged, and the container and bag as a whole collapsed and thus be easily transportable.

The present invention therefore consists of buoyant collapsible containers adapted to hold a liquid of density less than that of water, comprising a closed collapsible bag fixed to the skin of the buoyant container, said collapsible bag being capable of being filled with water.

It is to be understood that the term "water" used in this specification includes sea-water as well as fresh water.

The arrangement of the present invention is particularly suitable to inhibit the rolling of cylindrical or near-cylindrical liquid containers when being towed. In such instances the closed collapsible bag may consist of a tube extending substantially down the length of the cylindrical container. If desired, a plurality of tubes may be employed extending in a line down the container, which may or may not be connected with each other.

The closed collapsible bags are preferably made of similar material to the main container, for instance, they may be made of rubberized fabric, and are affixed to the main

container by any suitable means, such as by stitching.

The main container may be made of nylon proofed with rubber on the side in contact with water and a synthetic rubber, e.g. neoprene on the side in contact with oil, or it may be made with polyvinyl chloride. A net made of manilla or other material may support the outside of the container.

The present invention and modifications thereof may be further understood by reference to the drawings.

Fig. 1 of the accompanying drawings represents diagrammatically a cross-section of a cylindrical container according to the present invention. The skin of the cylindrical buoyant container 1 has affixed to the internal surface of its skin at 2 a collapsible cylindrical water-bag 3, disposed longitudinally of the container. Internally fixed water bags should preferably have a cross-sectional area when full of 1/25 to ½ the total cross-sectional area of the container when the latter is filled to design capacity. Fig. 2 of the accompanying drawings shows a modification of the arrangement wherein the water-bag 3 is affixed externally to the container 1. These representations are diagrammatical, and Fig. 3 represents a more practical arrangement wherein the water-bag 3 is faired into the container walls 1 at points 2^{I} and 2^{II} so as not to oscillate about a single securing line during towing.

Fig. 4 of the accompanying drawing represents a longitudinal section of a buoyant collapsible container 1 having a towing harness 2 fixed to its forward end, and terminating in a filling tube 3 at its after end sealed with a stopper 4. The water-bag 5 extends substantially the whole length of the container, having a filling outlet terminating in the after end within the outlet 3 for the liquid contents of the container.

Collapsible oil containers of the type described are not stable when being towed. The high length/diameter ratio of the containers render them susceptible to hydrodynamic forces causing them to oscillate about the mean path of advance.

It is thought that such snaking movements arise from the container taking up a curved shape when filled with its liquid cargo, i.e. the curved surface being at one point convex, and concave at a point diametrically opposite. Such a configuration is analogous to that taken up by a long toy balloon when inflated, or a sausage subjected to internal forces when being cooked. Such curved surfaces would then act when being towed in a manner akin to an aerofoil section the consequent generation of differential pressures on opposite sides of the container results in an oscillating movement.

A preferred embodiment of the present invention allows the oscillating movement of such containers when being towed to be inhibited by incorporating in the flexible skin of the container a plurality of longitudinally disposed straight rigid bars, the bars extending substantially down the length of the container.

The bars may be rods, although they are preferably tubes, as the weight/rigidity ratio of tubes is substantially smaller than that of circular rods. Further the rigidity of a tube is proportional to the fourth power of the diameter, and it is estimated that up to about 2″ diameter tubes have a rigidity comparable with solid bars of L or H cross-section.

Although it is envisaged that at least two bars should be incorporated in the skin of the container, it is preferred that from 6 to 24 bars should be disposed around the circumference of the container.

Although each bar in the fabric should be rigid, they nevertheless may conveniently be composed of a plurality of bar elements joined together to make a rigid bar. Such an arrangement is particularly expeditious for dismantling when it is desired to collapse the containers. Such bar elements may be joined together by any suitable locking device, for instance by screwing together in any of the ways shown in figures 5 to 7 of the accompanying drawing. Referring to Fig. 5 a tube element 1 is joined to an adjacent tube element 2 by means of a tapering thread 3 on one of the elements. In Fig. 6 the pipe elements 1 and 2 are joined by a threaded slug 4 engaging an internal thread 3 on both the pipe elements. In Fig. 7 the pipe elements are joined by a thread ring 3 engaging in an external thread 4 on the pipe elements.

If rods are used for the bar or bar elements, these may be of any suitable cross-section to impart rigidity for example a circular L or H shaped cross-section.

The bars are preferably made of metal, for example steel, which may be of the stainless variety, or plain steel having an anti-corrosion coating or a light alloy, particularly a salt-water-resistant aluminium-magnesium alloy.

The bars may be fitted into pockets along the side of the container, and may be further secured by flaps passing over them. Fig. 8 of the accompanying drawing is a diagrammatic view of the bars assembled onto the collapsible skin of the container according to the present invention. The container 1 has a towing end 2 to which towlines 3 are attached leading to a towing ring 4. The after end 5 terminates in a filling tube which is sealed by a removable cap 6. A rigid bar 7 extends substantially down the whole length of the container 1, being held by end-pieces 8 attached to the skin, and also secured by flaps 9 distributed along the length of the container and also attached thereto. The bars may have further securing means (not shown), which will ensure they do not slip out of the pocket 8 while in service. Instead of a pocket, other clamping means may be used.

WHAT WE CLAIM IS:—

1. Buoyant collapsible containers of the kind referred to, and adapted to hold a liquid of density less than water, comprising a closed collapsible bag fixed to the skin of the buoyant container, said collapsible bag being capable of being filled with water.

2. A container as claimed in claim 1 wherein the said collapsible bag is a cylindrical bag fixed to the internal surface of the skin, disposed longitudinally of the container.

3. A container as claimed in claim 2 wherein the cross-sectional area of the said collapsible bag when full is 1/25 to 1/12 the cross-sectional area of the container when the latter is filled to design capacity.

4. A container as claimed in any of claims 1 to 3 wherein there is incorporated on the outside of the flexible skin of the container a plurality of longitudinally disposed straight rigid bars, the bars extending substantially down the length of the container.

5. A container as claimed in claim 4 wherein from 6 to 24 bars are disposed around the circumference of the container.

6. A container as claimed in claim 4 or claim 5 wherein each bar is composed of a plurality of bar elements jointed together to make a rigid bar.

7. A container substantially as hereinbefore described and illustrated in any of the accompanying drawings.

K. J. VERYARD,
33, Davies Street, London, W.1,
Agent for the Applicants.

PROVISIONAL SPECIFICATION
No. 30075 A.D. 1957

Improved Collapsible Floating Containers for Liquids

We, ESSO RESEARCH AND ENGINEERING COMPANY, a Corporation duly organised and existing under the laws of the State of Delaware, United States of America, of Elizabeth, New Jersey, United States of America, do hereby declare this invention to be described in the following statement:—

It has previously been proposed that floating containers designed to hold liquids having a density less than water and to float in water may be made of collapsible fabric, for instance, rubberized fabric. Such containers are closed containers and may be filled with the liquid to be stored through an aperture specially designed for that purpose.

A particularly useful container of the above type is one that is capable of being towed. Such "collapsible barges" consist in effect of tubes, which may comprise one compartment or several compartments, which may or may not be connected to each other. One end of the tube has towing means connected to the ship or tug pulling it, and the other end may conveniently terminate in the filling pipe hereinbefore mentioned, although the after end may be blind. It has previously been found that when such a container is designed for being towed, the ratio of the length to the cross-sectional area of the container should be large. The most convenient cross-section of such containers has a cylindrical or near cylindrical form, and in such instances it has been found that ratio of length beam should be greater than 6:1, and preferably greater than 10:1. A particularly useful container is one having a length/diameter ratio of about 20:1.

Collapsible oil containers of the type described are not stable when being towed. The high length/diameter ratio of the containers render them susceptible to hydrodynamic forces causing them to oscillate about the mean path of advance.

It is thought that such snaking movements arise from the container taking up a curved shape when filled with its liquid cargo, i.e. the curved surface being at one point convex, and concave at a point diametrically opposite. Such a configuration is analogous to that taken up by a long toy balloon when inflated, or a sausage subjected to internal forces when being cooked. Such curved surfaces would then act when being towed in a manner akin to an aerofoil section the consequent generation of differential pressures on opposite sides of the container results in the oscillating movement hereinbefore described.

It has now been discovered that the oscillating movement of such containers when being towed may be inhibited by incorporating in the flexible skin of the container a plurality of longitudinally-disposed straight rigid bars, the bars extending substantially down the length of the container.

The bars may be rods, although they are preferably tubes, as the weight/rigidity ratio of tubes is substantially greater than that of circular rods. Further the rigidity of a tube is proportional to the fourth power of the diameter, and it is estimated that up to about 2" diameter tubes have a rigidity comparable with the solid bars of L or H cross-section.

Although it is envisaged that at least two bars should be incorporated in the skin of the container, it is preferred that from 6 to 24 bars should be disposed around the circumference of the container.

Although each bar in the fabric should be rigid, they nevertheless may conveniently be composed of a plurality of bar elements joined together to make a rigid bar. Such an arrangement is particularly expeditious for dismantling when it is desired to collapse the

containers. Such bar elements may be joined together by any suitable locking device, for instance by screwing together in any of the ways shown in figures 1 to 3 of the accompanying drawing. Referring to Fig. 1, a tube element 1 is joined to an adjacent tube element 2 by means of a tapering thread 3 on one of the elements. In Fig. 2 the pipe elements 1 and 2 are joined by a threaded slug 4 engaging an internal thread 3 on both the pipe elements. In Fig. 3 the pipe elements are joined by a threaded ring 3 engaging in an external thread 4 on the pipe elements.

If rods are used for the bar or bar elements, these may be of any suitable cross-section to impart rigidity for example a circular L or H shaped cross-section.

The bars are preferably made of metal, for example steel, which may be of the stainless variety, or plain steel having an anti-corrosion coating or a light alloy, particularly a salt-water-resistant aluminium-magnesium alloy.

The bars may be fitted into pockets along the side of the container, and may be further secured by flaps passing over them. Fig. 4 of the accompanying drawing is a diagrammatic view of the bars assembled onto the collapsible skin of the container according to the present invention. The container 1 has a towing end 2 to which towlines 3 are attached leading to a towing ring 4. The after end 5 terminates in a filling tube which is sealed by a removable cap 6. A rigid bar 7 extends substantially down the whole length of the container 1, being held by end-pieces 8 attached to the skin, and also secured by flaps distributed along the length of the container and also attached thereto. The bars may have further securing means (not shown), which will ensure they do not slip out of the pocket 8 while in service. Instead of a pocket, other clamping means may be used.

K. J. VERYARD,
33, Davies Street, London, W.1,
Agent for the Applicants.

PROVISIONAL SPECIFICATION
No. 30076 A.D. 1957

Improved Collapsible Floating Containers for Liquids

We, ESSO RESEARCH AND ENGINEERING COMPANY, a Corporation duly organised and existing under the laws of the State of Delaware, United States of America, of Elizabeth, New Jersey, United States of America, do hereby declare this invention to be described in the following statement:—

It has previously been proposed that floating containers designed to hold liquids having a density less than water and to float in water, may be made of collapsible fabric, for instance, rubberized fabric. Such containers are closed containers and may be filled with the liquid to be stored through an aperture specially designed for that purpose.

A particularly useful container of the above type is one that is capable of being towed. Such "collapsible barges" consist in effect of tubes, which may comprise one compartment or several compartments, which may or may not be connected to each other. One end of the tube has towing means connected to the ship or tug pulling it, and the other end may conveniently terminate in the filling pipe hereinbefore mentioned, although the after end may be blind. It has previously been found that when such a container is designed for being towed, the ratio of the length to the cross-sectional area of the container should be large. The most convenient cross-section of such containers has a cylindrical or near cylindrical form, and in such instances it has been found that ratio of length to beam should be greater than 6:1, and preferably greater than 10:1. A particularly useful container is one having a length/diameter ratio of about 20:1.

It has been found that cylindrical or near-cylindrical containers of the type described above, tend to roll, particularly when being towed. This rolling action is generally undesirable, due to the necessity of keeping gas vents and other devices above the water-line, and is due to the centre of buoyancy being coincident with the centre of gravity of the container.

It has now been discovered that the tendency to roll of floating containers of the kind referred to may be inhibited by the presence of a water-filled collapsible bag fixed to the skin of the container. Thus when the container is filled with the liquid of density less than water, the water-filled bag will tend to reach a point directly beneath the centre of buoyancy of the liquid-filled container, and act as a keel. It has the further advantage that after the liquid cargo of the container has been discharged, the water in the collapsible bag may also be discharged, and the container and bag as a whole collapsed and thus be easily transportable.

The present invention therefore consists of buoyant collapsible containers adapted to hold a liquid of density less than that of water, comprising a closed collapsible bag fixed to the skin of the buoyant container, said collapsible bag being capable of being filled with water.

It is to be understood that the term "water" used in this specification includes sea-water as well as fresh water.

The arrangement of the present invention is particularly suitable to inhibit the rolling of cylindrical or near-cylindrical liquid con-

tainers when being towed. In such instances the closed collapsible bag may consist of a tube extending substantially down the length of the cylindrical container. If desired, a plurality of tubes may be employed extending in a line down the container, which may or may not be connected with each other.

The closed collapsible bags are preferably made of similar material to the main container, for instance, they may be made of rubberized fabric, and are affixed to the main container by any suitable means, such as by stitching.

The present invention and modifications thereof may be further understood by reference to the accompanying drawings.

Fig. 1 of the accompanying drawings represents diagrammatically a cross-section of a cylindrical container according to the present invention. The skin of the cylindrical buoyant container 1 has affixed to the internal surface of its skin at 2 a collapsible cylindrical water-bag 3. Internally fixed water bags should preferably have a cross-sectional area when full of 1/25 to ½ the total cross-sectional area of the container when filled to design capacity. Fig. 2 of the accompanying drawing shows a modification of the arrangement wherein the water-bag 3 is affixed externally to the container 1. These representations are diagrammatical, and Fig. 3 represents a more practical arrangement wherein the water-bag 3 is faired into the container walls 1 at points 2^{I} and 2^{II} so as not to oscillate about a single securing line during towing.

Fig. 4 of the accompanying drawing represents a longitudinal section of a buoyant collapsible container 1 having a towing harness fixed to its forward end, and terminating in a filling tube 3 at its after end sealed with a stopper 4. The water-bag 5 extends substantially the whole length of the container, having a filling outlet terminating in the after end within the outlet 3 for the liquid contents of the container.

K. J. VERYARD,
33, Davies Street, London, W.1,
Agent for the Applicants.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press.—1959.
Published by The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

826,301 PROVISIONAL SPECIFICATION No 30076 5.7

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig.1.

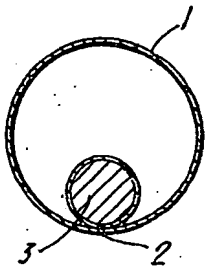


Fig.2.

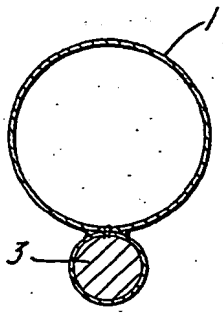


Fig.3.

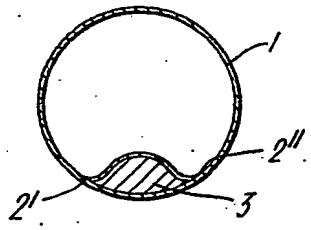


Fig.4.

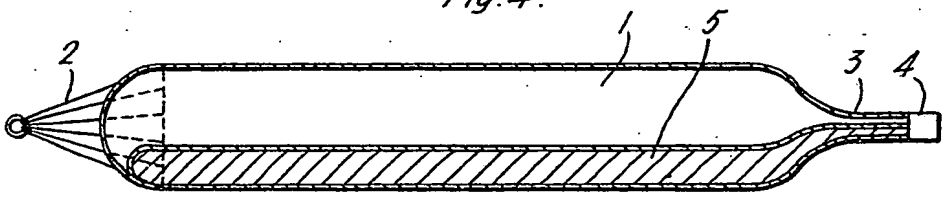


Fig.1.

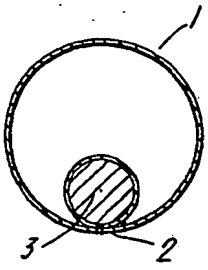


Fig.2.

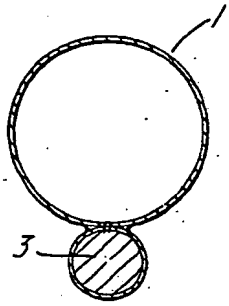


Fig.3.

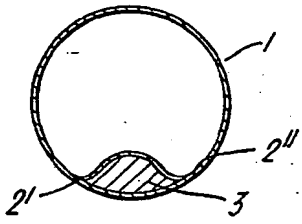
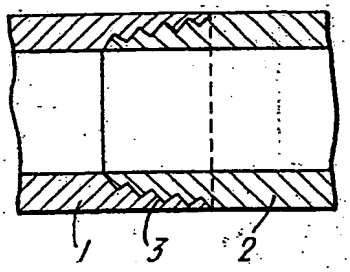


Fig.5.



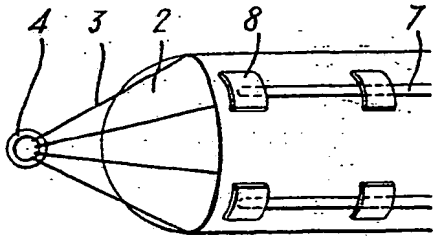
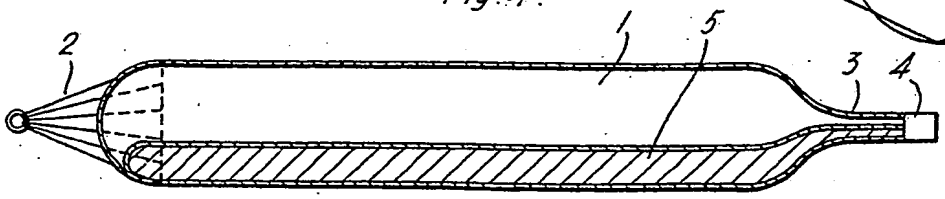


Fig.4.



826,301 COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig.5.

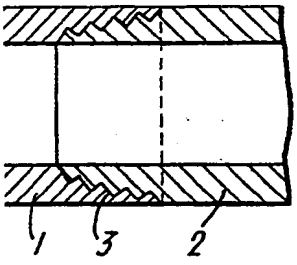


Fig.6.

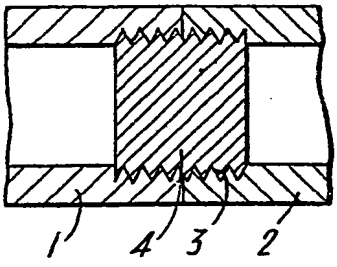


Fig.7.

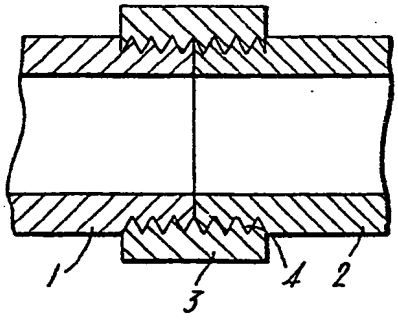
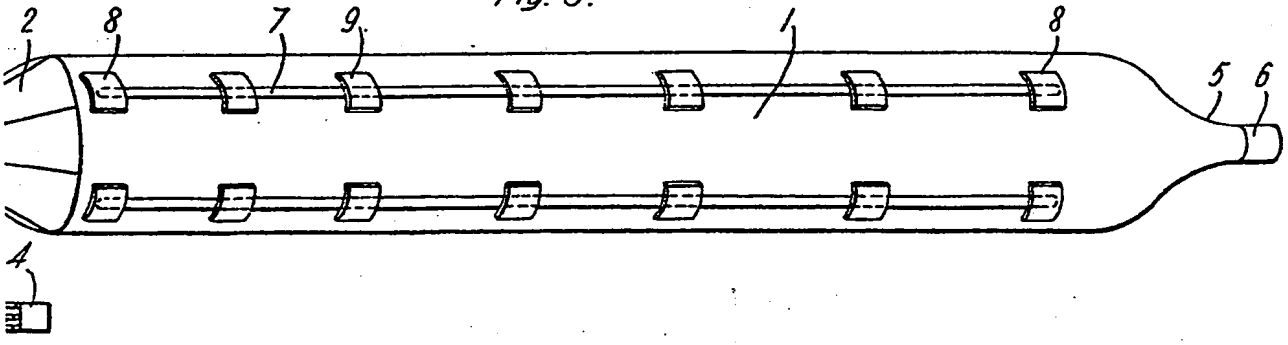


Fig. 8.



826,301 COMPLETE SPECIFICATION
1 SHEET
This drawing is a reproduction of the Original on a reduced scale.

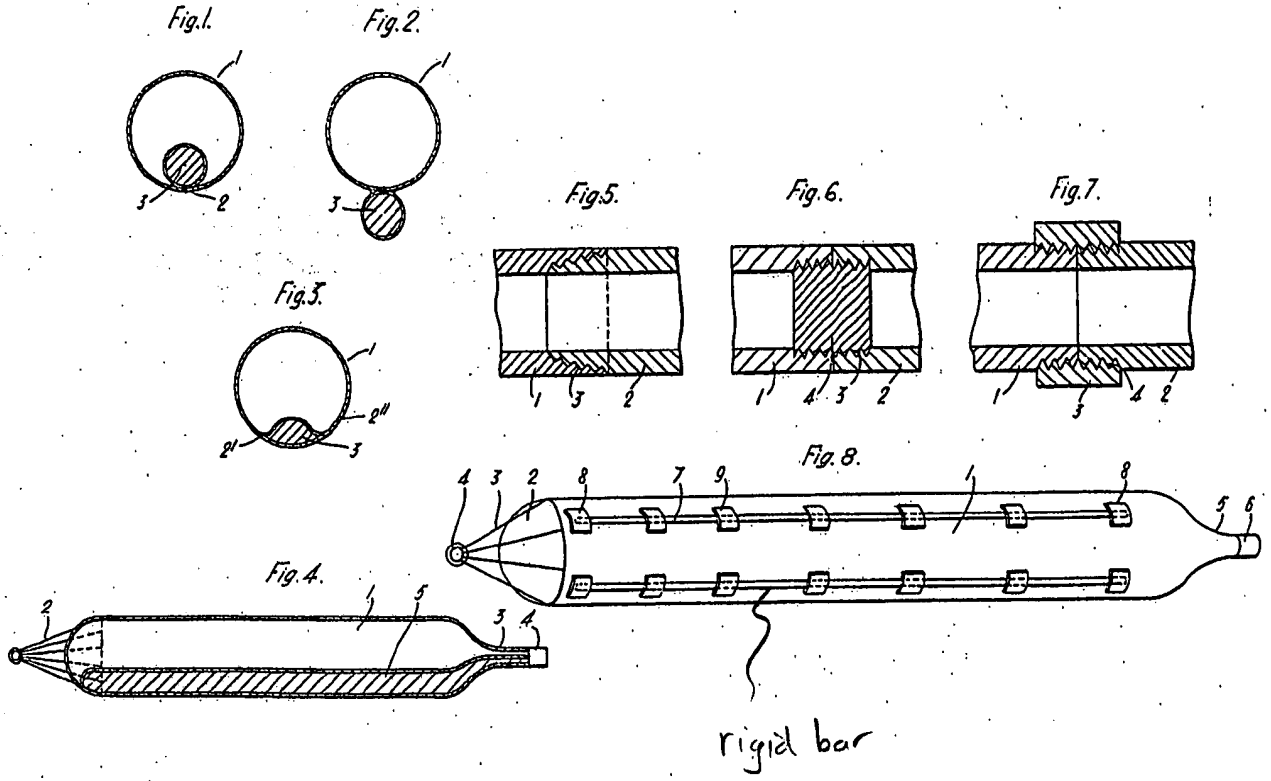


Fig. 1.

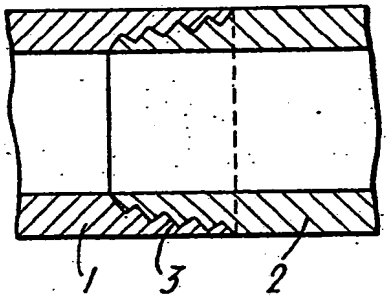


Fig. 2.

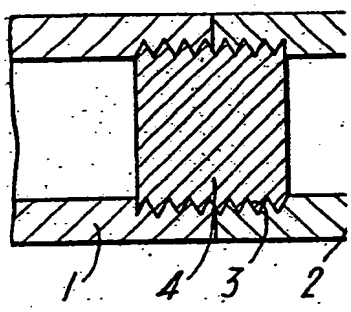
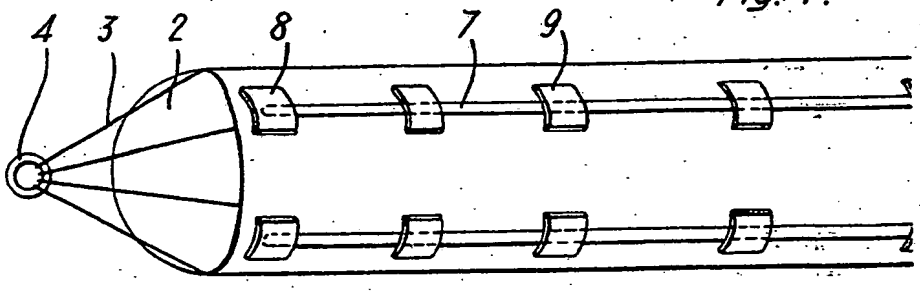


Fig. 4.



826,301 PROVISIONAL SPECIFICATION No 30075 57

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig. 2.

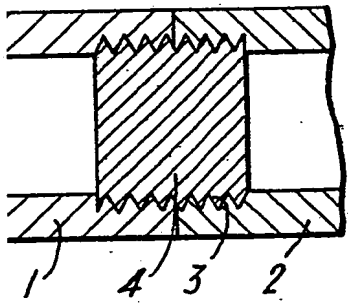


Fig. 3.

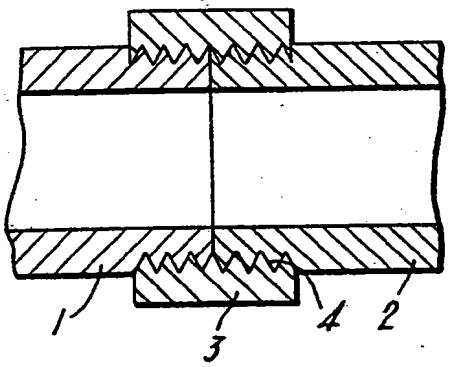
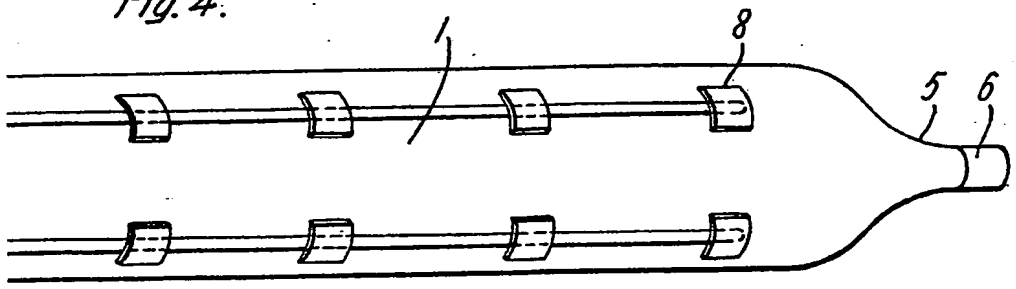


Fig. 4.



826,301 PROVISIONAL SPECIFICATION No 30075 57
1 SHEET This drawing is a reproduction of the Original on a reduced scale.

Fig. 1.

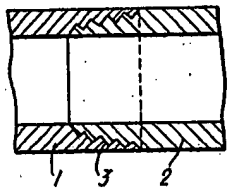


Fig. 2.

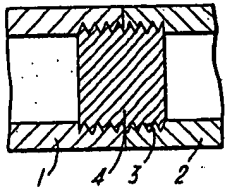


Fig. 3.

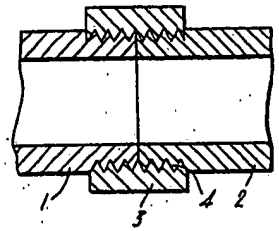


Fig. 4.